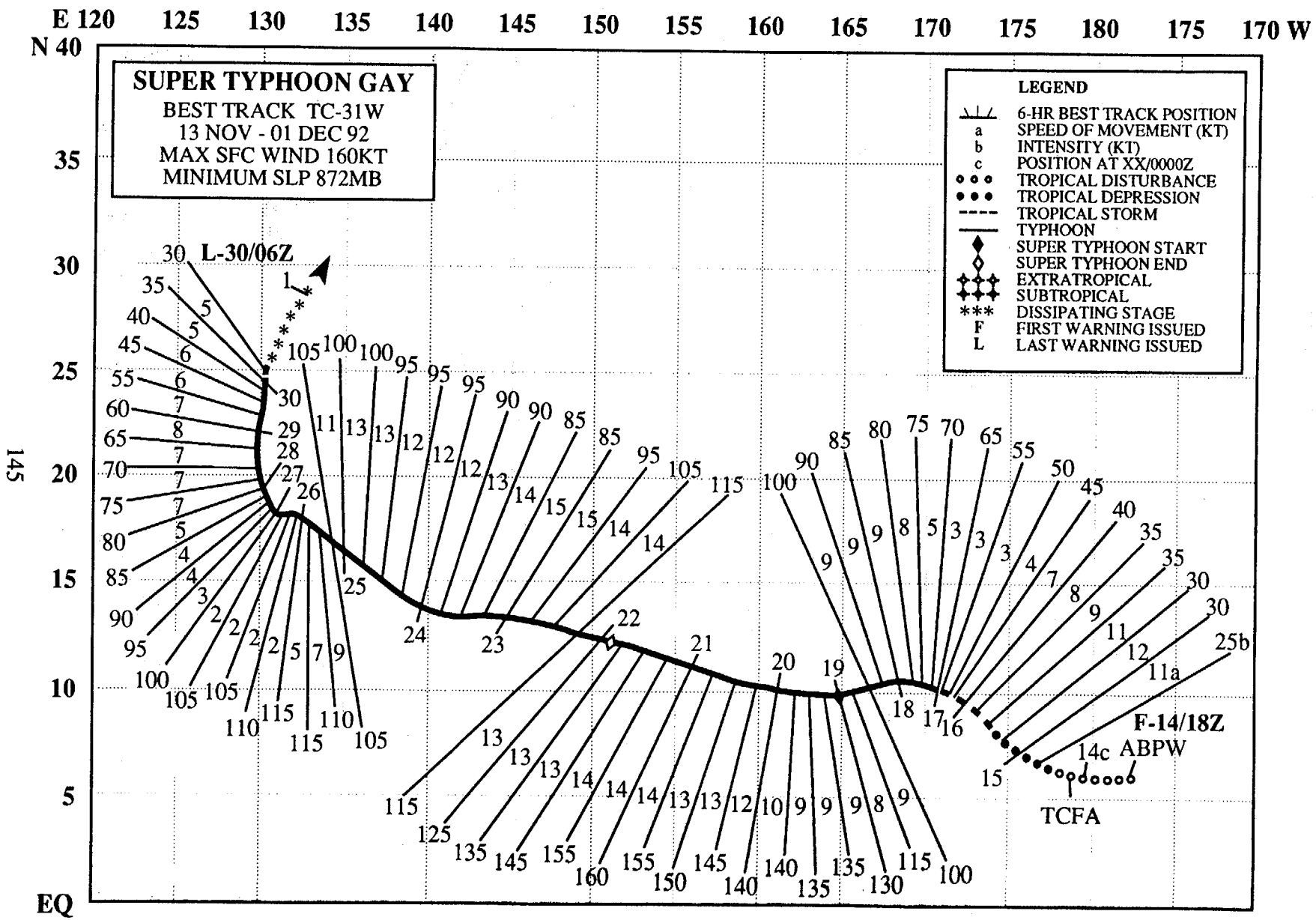
E 120 125 130 135 140 145 150 155 160 165 170 175 180 175 170 W
N 40
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EQ
145
SUPER TYPHOON GAY
BEST TRACK TC-31W
13 NOV - 01 DEC 92
MAX SFC WIND 160KT
MINIMUM SLP 872MB
LEGEND
6-HR BEST TRACK POSITION
a SPEED OF MOVEMENT (KT)
b INTENSITY (KT)
c POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
SUBTROPICAL
*** DISSIPATING STAGE
F FIRST WARNING ISSUED
L LAST WARNING ISSUED
L-30/06Z
F-14/18Z
14c ABPW
TCFA

SUPER TYPHOON GAY (31W)

I. HIGHLIGHTS

Gay was noteworthy for five reasons: its eye became the record third to pass across Guam in less than three months; it was estimated to be the most intense tropical cyclone to occur in the western North Pacific since Super Typhoon Tip in October of 1979; it went through two intensification periods, which is not rare but is relatively uncommon; it filled an estimated 99 mb in less than 48 hours without moving over land; and, it required the highest number of warnings, 63, for any western North Pacific tropical cyclone in 1992. Four days after being detected as a tropical disturbance, Gay slammed into several of the Marshall Islands with typhoon force winds. After peaking with sustained winds of 160 kt (82 m/sec) with gusts to 195 kt (100 m/sec), the super typhoon weakened for two days before reaching Guam. Typhoon Gay passed across the center of Guam on 23 November, then reintensified to a second peak before recurving, and dissipating over water south of Japan.

II. TRACK AND INTENSITY

On 13 November, the tropical disturbance that became Super Typhoon Gay was detected just east of the international date line in the monsoon trough which extended westward through the southern Marshall Islands, where Hunt (32W) was forming, to Tropical Storm Forrest (30W) in the South China Sea. JTWC first mentioned the disturbance as a convective area with fair potential for development on the 130600Z November Significant Tropical Weather Advisory. As the disturbance moved westward, the overall area of cloudiness decreased, but there was a marked increase in central convection and organization. To address this development, the Center issued a Tropical Cyclone Formation Alert at 140500Z. Intensification continued and the first warning followed at 141800Z with an upgrade to Tropical Storm Gay at 150000Z.

As Gay approached the Marshall Islands and slowed, it intensified reaching typhoon intensity at 170000Z. Mejit Island and the atolls of Ailuk and Wotje, just east-northeast of Kwajalein Atoll, were the first to be buffeted by the typhoon which inflicted considerable damage. Then Typhoon Gay swept westward, passing 60 nm (110 km) north of Kwajalein, and later over Wotho Atoll, where all the homes and crops were destroyed, fortunately without any loss of life. At 190600Z, JTWC upgraded Gay to a super typhoon, the peak intensity of 160 kt (82 m/sec) based on estimates from satellite imagery was not reached until 210000Z. This peak intensity, although estimated, established Gay as the most intense typhoon to occur in the western North Pacific since Typhoon Tip peaked in October 1979 with sustained winds of 165 kt (85 m/sec).

In the meantime, Typhoon Hunt (32W) had brushed by Guam, intensified, recurved, and was located, on 21 November, on the north side of the subtropical ridge, north of Guam, and north-northwest of Super Typhoon Gay. From this position, Hunt's strong upper-level outflow combined with a massive upper-level anticyclone to the north-northeast of Gay brought strong northeasterly flow to bear on Gay, decapitating the north side of its well organized thunderstorm structure. As a consequence, sea-level pressures began to rapidly rise within the typhoon's eye, the torrential rains abated, and the winds within the core region spun down faster than forecast by JTWC.

Fortunately, for the southern Mariana Islands, the weakening trend continued at a phenomenal rate of 10 kt (5 m/sec) per 6 hours, and JTWC downgraded the super typhoon to typhoon status at 221200Z. Twelve hours later, Gay crossed Guam (Figure 3-31-1) packing sustained winds of 85 kt (44 m/sec) gusting to 105 kt (54 m/sec). Post analysis indicates that during the rapid weakening event,

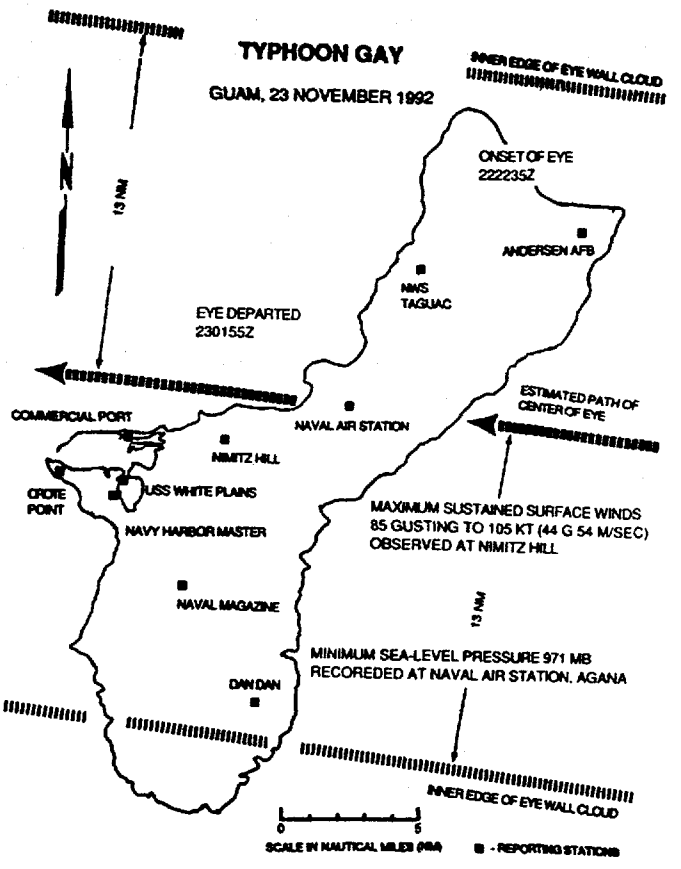

Figure 3-31-1. Graphic depicting the passage of the eye of Typhoon Gay across the island of Guam on 23 November.

JTWC's intensity estimates lagged the actual intensities by about 12 hours. The eye passage at Nimitz Hill is graphically shown on the pressure trace in Figure 3-31-2. The minimum sea-level pressure of 971 mb was recorded at the Naval Air Station. In Figure 3-31-3, the Nimitz Hill wind speed and direction record shows the light winds during the eye passage and that the wind direction gradually shifted in a clockwise direction. The wind record also shows that before the eye passed, the north-northwest winds were more uniform or stable, while in contrast, after the eye passed, the flow across Nimitz Hill was southerly, more turbulent and stronger. In terms of strength and size, Gay was large, nearly 800 nm (1480 km) across. As a result, the winds at Andersen AFB (WMO 91218), Guam gusted to gale force (33 kt (17 m/sec)), or higher, for 24 hours. Even with the duration and strength of these winds, the structural damage on Guam and Rota was relatively light. Damage would have been much greater, probably in the tens of millions of dollars, had Typhoon Omar (15W) not hit Guam less than three months earlier and destroyed the weaker structures. Nevertheless, due to surprisingly light 24-hour rainfall amounts from 1.5 to 3.5 inches (40 to 90 mm), the winds of this "dry" typhoon were ladened with salt and left the island's new growth of vegetation and crops as if scorched or seared from intense heat. The maximum storm surge and wave runup were generally from 5 to 7 feet (2 m) on northern exposed reefs and beaches with a maximum near the Cabras port/container area of 9 to 11 feet (3 m) ((Figure 3-31-4).

On 23 November, the effect of Hunt's (32W) outflow on Gay lessened. The environment allowed the deep thunderstorm structure to redevelop, and Typhoon Gay reintensified, reaching a second peak of 115 kt (59 m/sec) at 251800Z (Figure 3-31-5). The typhoon stalled for two days and weakened south-southeast of Okinawa, Japan before tracking to the north on 27 November. As Gay recurved

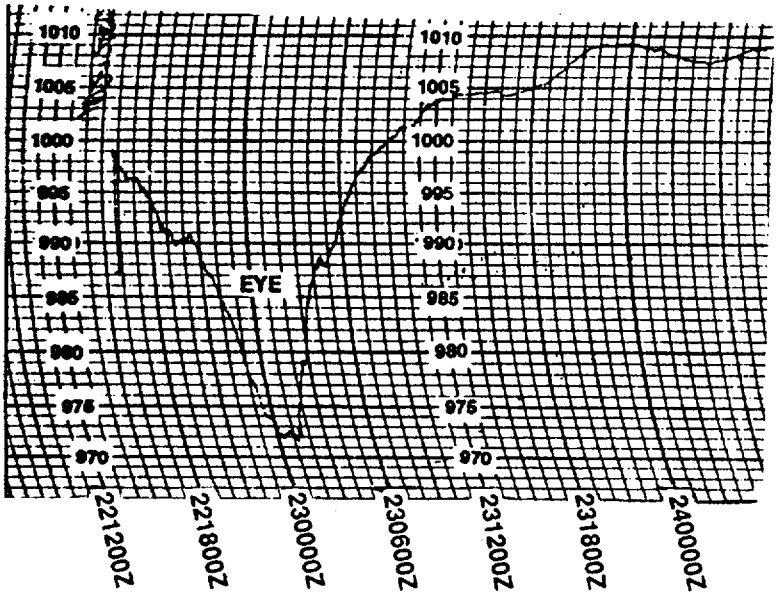

Figure 3-31-2. The microbarograph trace for Nimitz Hill, Guam shows the passage of Typhoon Gay's center on 23 November. The instrument, which was corrected to sea level, recorded a minimum pressure of 972 mb.

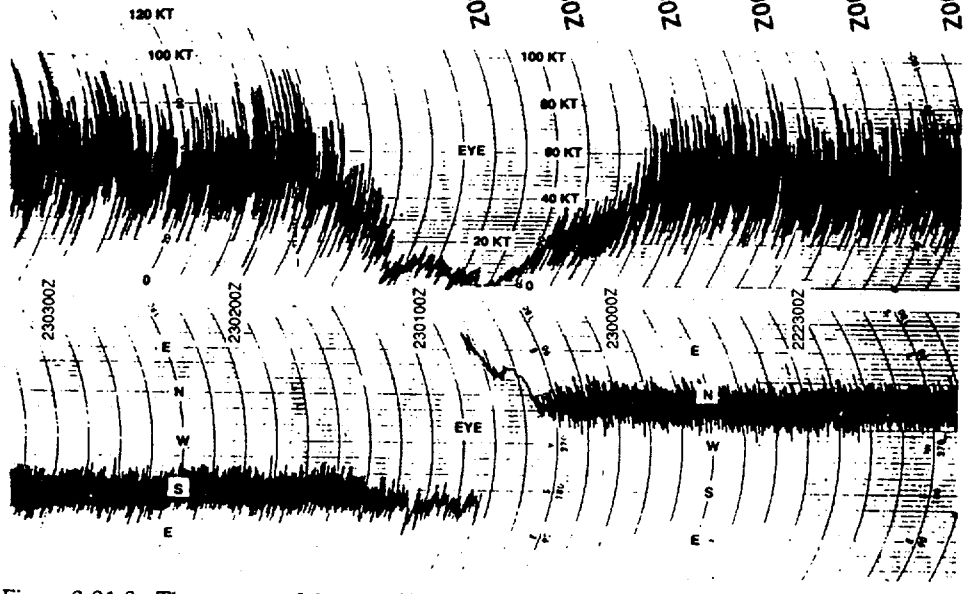

Figure 3-31-3. The passage of the eye of Typhoon Gay as measured by the anemometer at Nimitz Hill, Guam on 23 November.

southeast of Okinawa on 30 November, JTWC downgraded the typhoon to a tropical storm. The following day, the last of 63 warnings, the most for any 1992 tropical cyclone, was issued at 300600Z as the system dissipated over water south of Japan.

III. FORECAST PERFORMANCE

The overall mean track forecasting errors were 85, 155 and 200 nm (155, 285 and 370 km) for 24, 48 and 72 hours, respectively. JTWC's performance was 60-70% better than average, and provided an overall 70, 60 and 55% improvement over CLIPER for the 24-, 48- and 72-hour forecasts, respectively. JTWC got a head start on the aids on the very first warning by correctly anticipating Gay's track toward Guam. While JTWC had a fairly good handle on the tropical cyclone's motion, the dynamic guidance consistently recurved Gay well east of Guam. The numerical model guidance provided by NOGAPS actually got worse as the typhoon approached Guam, even depicting movement to the north as Gay passed directly overhead. NOGAPS predicted that Typhoon Hunt (32W) would stall east of Guam and that Gay would take a more northerly course, recurving prior to Hunt. OTCM, FBAM,

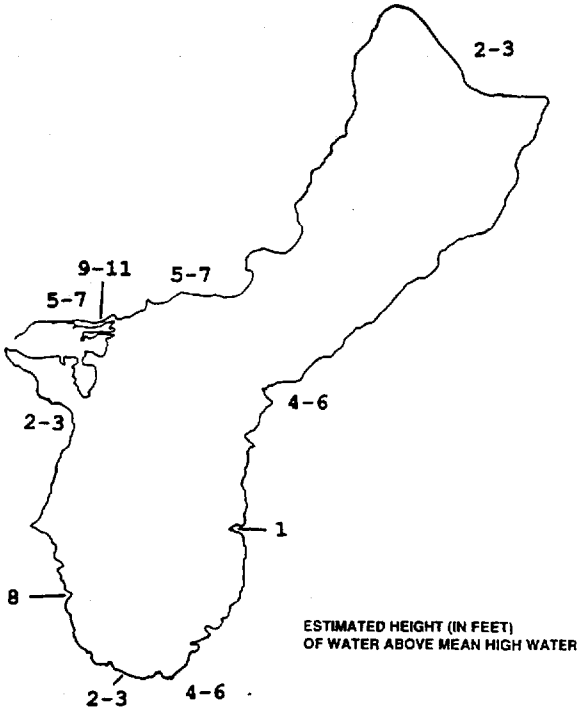

Figure 3-31-4. Estimates of the storm surge and wave runup experienced on Guam from the passage of Typhoon Gay on 23 November.

JTYM, EGRR, and CSUM all followed suit. Once Hunt recurved, the models, which had had trouble handling the two vortices, provided better guidance for Gay's track. By 26 November, as Gay approached the western extent of the mid-tropospheric subtropical ridge axis, most of the dynamic objective aids were back on track providing good guidance about the recurvature point and subsequent motion.

Gay was estimated to be the most intense tropical cyclone in the western North Pacific since Typhoon Tip in October 1979, and was identified early on as a probable rapid intensifier based on the tropical cyclone climatology for the location, time of year, sea surface temperature distribution and upper-tropospheric wind patterns. Prior to Gay's landfall on Guam, the Center also correctly predicted a decrease in intensity, due to the strong vertical wind shear from Typhoon Hunt (32W) to the north, but not nearly as fast as the weakening occurred. As Gay weakened, JTWC correctly anticipated the expansion of the typhoon's surface wind distribution and recommended that Conditions of Readiness 1 be set for the southern Mariana Islands of Guam, Rota, Tinian and Saipan. Reintensification after Gay passed to the west of Guam was also predicted based on the decreasing vertical wind shear from Hunt (32W).

IV. IMPACT

Gay bulldozed a path of destruction through most of the northern Marshall Islands, where the typhoon left over 5,000 people homeless, and knocked out power, water, and radio communications in Majuro. Miraculously, only one islander in the entire republic was injured, which reflects positively on the quality of the warning and disaster preparedness. President Amata Kabua declared Mejit Island and eight other northern atolls disaster areas. The hardest hit island was Wotho Atoll, population 160, where all trees and houses "fell down!" Amazingly, no one was injured as Gay ripped through the small atoll. Mejit Island fared only slightly better. They lost all wooden structures on the island, leaving almost all of the 445 people on that island homeless. The winds were so strong that most of the coconut trees

were blown down and 75% of the crops were lost. Ailuk Atoll suffered about the same crop losses as Mejit, but only had minor house damage. Utirik and Likiep Atolls suffered 50% crop and tree losses, and experienced damage to half of their houses. Maloelop and Aur Atolls were on the fringes of the damaging winds and only suffered 20 - 30% crop and house damage. Most of the atolls were without fresh drinking water for weeks or months after the typhoon, as catchment basins were destroyed or contaminated with salt water.

Majuro, the capital of the Marshall Islands, suffered from island-wide power outages due to lightning strikes. Another lightning strike hit the Outer Island Dispensary and knocked out the radio link to 67 of the outer island hospitals. One boat smashed into the seawall and sank as it broke loose in Majuro Harbor. For two days after Gay's passage, Air Marshall Island flights were canceled until the debris could be cleared from the runways.

Gay's next target was Guam. Passing over the center of the island, Gay became the fifth typhoon to pass within 60 nm (110 km) in less than three months, and everyone in the Marianas Islands took Gay's threat extremely seriously. Just to the north, Saipan recorded a record 1639 people in shelters as Gay passed, and twelve families had to be evacuated from their homes by emergency crews as the storm surge threatened to sweep away their houses. One house was destroyed by the storm surge and another was damaged by a fire caused by burning candles and kerosene lamps used after the power was out. On Tinian, four houses lost their sheet iron-roofs to Gay.

On Guam, it was difficult to isolate the damage from Gay alone because Typhoon Omar (15W) had already destroyed most of the weaker structures. The most visible result of Gay's passage over Guam was to the crops and vegetation on the island. Gay was a "dry" cyclone, and airborne salt whipped up from the ocean as the typhoon passed burnt the vegetation. Farmers suffered the most losses due to Typhoon Gay. The typhoon disrupted everyday life for the fifth time during the year: ships were sent to sea; 4,300 residents sought typhoon shelters; the port and airports were shut down; schools and other government and civilian offices were closed, and the power plant was placed in standby operation. The storm surge brought sand, coral rubble and water ashore, especially in the area of the Cabras Island port access road. Some wharf damage occurred when a fishing vessel broke loose from its mooring, and a fuel storage tank that was under construction collapsed. It must be remembered that it could have been worse, had it not been for the incredible timing of Typhoon Hunt's (32W) interaction with Gay, Guam would have had to face the devastation of a super typhoon.

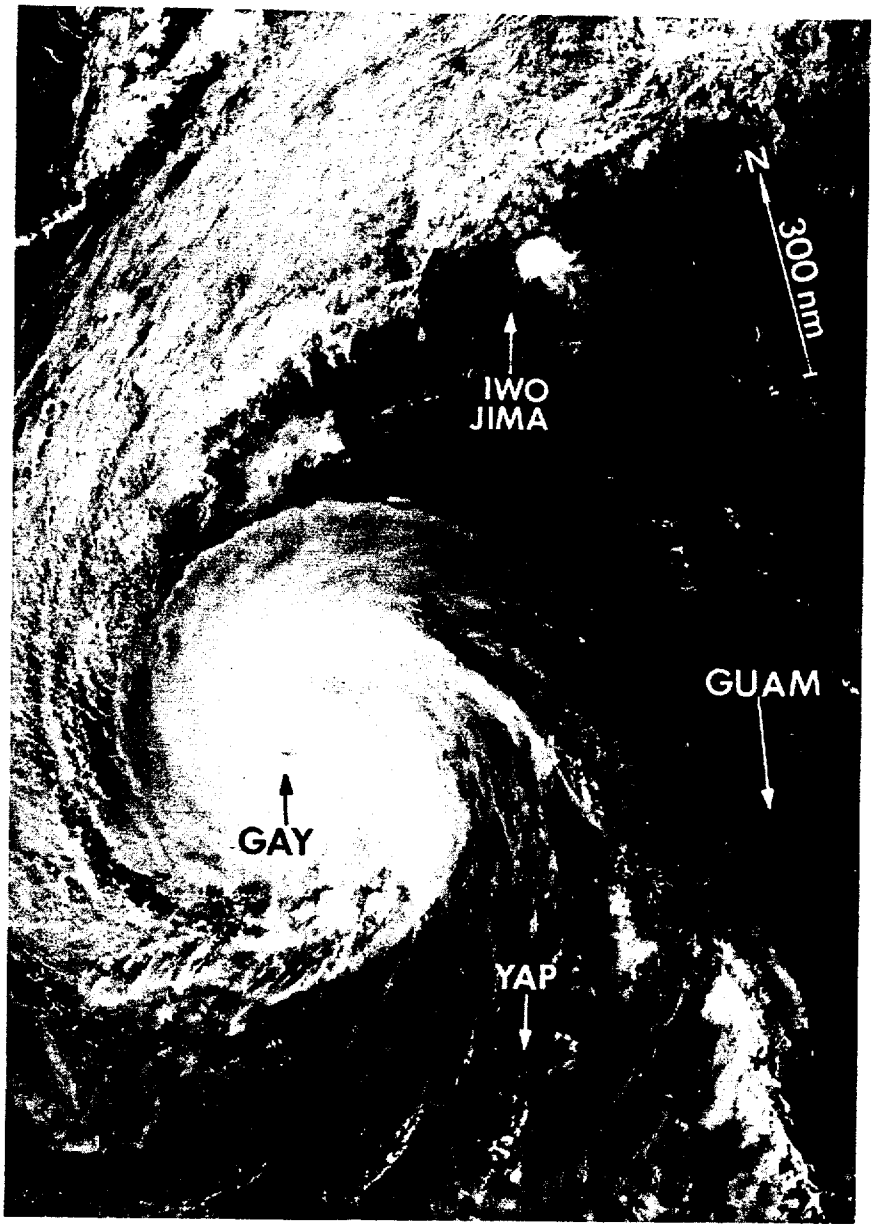

Figure 3-31-5. Gay's cloud filled eye is visible as the typhoon approaches it second peak intensity. The circulation is large which is typical of November typhoons (242348Z November DMSP visual imagery).